84198

THE ROYAL SOCIETY.

SIR FREDERICK GOWLAND HOPKINS,
PRESIDENT.

CONVERSAZIONE

BURLINGTON HOUSE.

May 17th, 1933.

DEMONSTRATIONS WILL BE GIVEN IN THE MEETING ROOM (GROUND FLOOR) AT THE TIMES SPECIFIED BELOW. FURTHER PARTICULARS ARE GIVEN ON PAGE 27.

AT 9.15 AND 10.15 O'CLOCK—ON RECENT DEVELOPMENTS OF INFRA-RED PHOTOGRAPHY.

AT 9.45 AND 10.45 O'CLOCK—ON THE HOUSTON MOUNT EVEREST EXPEDITION.

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REFRESHMENTS IN THE ANTE-ROOM ON THE GROUND FLOOR.

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Descriptive Catalogue.

The descriptions of Exhibits in this Catalogue are supplied by the Exhibitors, who alone are responsible for their accuracy.

ROOM 1.

1. *Professor C. H. Lander, Dr. Margaret Fishenden and Mr. O. A. Saunders.*

Quantitative Measurement of Heat Transfer by Refraction of Light.

The refraction of light can be used for measuring convection heat transfer in both gases and liquids and for both stream-line and turbulent conditions.

A parallel beam of light at grazing incidence is deflected away from a heated surface because of the gradient of temperature (and consequently of refractive index) normal to the surface. The heat transfer is calculated from the deflection registered on a suitably placed screen, and for turbulent conditions can be observed to oscillate about a mean value.

The exhibit shows the application of the new method to :—

(*a*) A horizontal cylinder with open ends in air.
(*b*) A horizontal plate in air (turbulent conditions).
(*c*) A vertical plate in water.

2. *The National Physical Laboratory.*

Statistical observations of Turbulence in Airflow in a pipe, and instantaneous velocity distribution over the critical Reynolds number (*Dr. H. C. H. Townend*).

A periodic electric spark is produced between fine electrodes in the airstream. The small mass of heated air thus produced is rendered visible by the Schlieren method, and its motions are thrown on a screen or photographed with a cinematograph camera and a synchronous stroboscope. In laminar motion a row of stationary equidistant dots is seen, but in turbulent motion the dots in successive pictures oscillate about the mean position and statistical measurements are made of their displacements, giving u, v and w, the turbulent velocity components.

The velocity distribution is obtained by using seven spark gaps in series. Incipient breakdown is indicated by deformation of the laminar distribution.

3. *Standard Telephones and Cables, Ltd.*

Recent advances in low voltage Cathode Ray Oscillograph tubes and equipment and of vacuum tube Oscillators.

A number of Cathode Ray Oscillograph tubes will be shown, including various types having metallised shields, independent deflecting plates and fluorescent screen materials. A new miniature type will also be exhibited. A number of the tubes will be in operation demonstrating various applications.

A Heterodyne type vacuum tube oscillator will be exhibited which covers the whole range from 20 to 12,000 cycles on a single control, the frequency being indicated on a wide open scale directly calibrated. A small A.C. mains-operated switch type oscillator, covering the range 20 to 10,000 cycles, will also be shown.

ROOM 2.

(RECEPTION ROOM.)

The Mace of the Royal Society.
Presented by **King Charles II** in 1663.

4. *The Director, Royal Botanic Gardens.*

Witch Broom of Silver Fir.

The "brooms" are caused by the fungus *Melampsorella caryophyllacearum* Schroet. (= *Aecidium elatinum* A. et S.), a heteroecious rust producing spermogonia and æcidia on *Abies pectinata* and uredo- and teleutospores on Caryophyllaceous weeds (*Cerastium* and *Stellaria*).

The æcidium stage (*Aecidium elatinum* A. et S.) has long been known and is very rare in this country. The connection with the rust on Caryophyllaceæ was established by Ed. Fischer in 1901.

5. *Messrs. Adam Hilger, Ltd.*

1. Instruments for Clinical and Biochemical Purposes.

(*a*) *The Hilger-Renshaw apparatus for the examination of blood.*—A portable, self-contained, photo-electric apparatus by means of which the usual clinical blood tests can be carried out with increased facility.

(*b*) *Apparatus for determining the Vitamin A content of fish liver oils.*—Fluorescence of a screen, produced by the filtered ultra-violet light of an iron arc, is reduced by the absorption of the oil contained in a quartz cell. A comparison field is reduced in intensity at will to match the first by means of a variable aperture.

(*c*) *The Williams-Rayleigh Interference Refractometer.*—For measuring exceedingly small differences in refractive index.

2. Specimens of Optical Work.

(*a*) Large quartz prism built of separate pieces in optical contact.

(*b*) Quadruple lens of fluorite, quartz and sylvine for the ultra-violet.

(*c*) Accurate cells of fused silica, adhesed without the use of cement.

3. A new series of fine Mechanical Adjustments for research purposes.

These enable positive control to be applied to levelling tables and similar accessories, and are demonstrated in their application to the mirror mounts of a Hilger Prism Interferometer.

4. Photographs taken with a Williams Reflection Echelon. Taken by and exhibited by kind permission of Mr. W. E. Williams, M.Sc.

6. *Mr. P. M. S. Blackett, F.R.S.*

Some Photographs of the Tracks of Penetrating Radiation.

Photographs taken by the Cloud method of the tracks of the high-speed particles associated with penetrating radiation. The particles are made to take their own photographs by the use of Geiger Counters, which operate a relay mechanism. A magnetic field of 2,000 gauss is maintained over the chamber.

The photographs show single and multiple tracks, due to particles of high energy. The majority seem to be due to negative and positive electrons.

7. *Dr. J. Chadwick, F.R.S., Mr. P. M. S. Blackett, F.R.S., and G. P. S. Occhialini.*

Some Positive Electron Tracks using a Neutron Source.

A Polonium-Beryllium source of neutrons is placed outside a cloud chamber. A lead plate is placed inside. Tracks of electrons are found coming from the lead plate. Some of the tracks are curved as for a negative charge and some as for a positive charge. The latter must be due to " positive electrons."

It is not possible as yet to say whether these positive electrons are produced by the neutron or by the accompanying γ radiation.

8. *The Brown-Firth Research Laboratories.*

(*a*) Illustrating certain Corrosion Phenomena.

1. Ordinary steel and 14 per cent. chromium steel—comparison of presence and absence of the resistant passive film.

2. Control of the foregoing film, its formation and removal on an 18/8 chromium nickel steel.

3. " Periodic " corrosion effect of a carbon steel in hot nitric acid, illustrating alternate production and destruction of passivity.

4. Samples undergoing corrosive attack as viewed through the microscope, showing initial breakdown.

5. Intercrystalline corrosion effect (disintegration). Resistant and non-resistant samples under test.

(*b*) A method of automatic Temperature Control for electric heating furnaces, for " Creep " testing apparatus, showing control within $\pm$ 0·05° C.

(*c*) Close " fits " of plug and ring, illustrating (1) thermal expansion effects on high and low expansion steels. (2) Precision work on super-hardened steel piston of aluminium-chromium steel.

9. *Rothamsted Experimental Station.*

The Action of Nitrates in preventing the Infection of Root-hairs by Bacterium radicicola (*Dr. H. G. Thornton*).

Infection by the nodule-forming organism always takes place through root-hairs previously deformed in a characteristic manner. This deformation has been shown to be produced by a filterable secretion of the nodule bacteria. The presence of nitrate checks the action of the secretion, thus inhibiting infection, since the bacteria never enter normal root-hairs. Nitrate does not prevent the bacteria from secreting the hair-deforming substance, but protects the root-hairs against its action.

10. *Rothamsted Experimental Station.*

Reversion of Cultivated Land to Natural Vegetation (*Dr. Winifred E. Brenchley and Miss Katherine Warington, M.Sc.*).

Three main phases of colonisation have been observed at Rothamsted on two areas originally under arable cultivation (Broadbalk and Geescroft " Wildernesses ").

I.—Colonisation by weeds from buried seeds and vegetative organs. The potential flora from this source is illustrated by numerical records recently obtained from soil samples of known volume.

II.—Competition between the weed flora and other species introduced by various agencies. This phase is maintained to some extent on Broadbalk by periodical removal of shrubby growth.

III.—Reversion to natural flora, the type of vegetation being determined by soil conditions.

(1) Oak-hazel wood on Broadbalk, the soil being adequately drained and containing some calcium carbonate.

(2) Stooled meadow type on Geescroft, largely *Aira cæspitosa* with scattered shrubs, the soil being water-logged and acid.

11. *Imperial Chemical Industries (Alkali), Ltd.*

Apparatus for carrying out chemical reactions up to 12,000 atmospheres.

Apparatus for high temperature experiment.

A greaseless valve.

Oriented overgrowths in crystals.

ROOM 3.

12. *The Marine Biological Association.*

Polychæta of the Plymouth District.

The exhibit is arranged in two sections. The first consists of a display of living Polychæte worms illustrating structural variation within the Order and, so far as possible, the mode of life of certain species. In the second section are shown a number of drawings and mounted microscope preparations of the embryological development of a few selected species.

13. *Mr. A. G. Lowndes.*

Film Record of Rapid Movements.

By means of a rapidly rotating disc a number of images of an object are received on a cine-film working at the ordinary rate. If the object is still the images are superimposed or coincide, but if the object is moving the images are spread out over the film.

The apparatus shown makes 300 exposures per second possible, and by it the spasmodic movements of copepods have been investigated. Cilia have also been investigated.

A rate of 3,000 exposures per second, or more, should be obtainable by this simple method.

14. *The National Physical Laboratory.*

Two Experiments illustrating Methods of Investigating the Ionosphere. (*Radio Department*).

1. A cathode-ray oscillograph is used stroboscopically, by allowing the focussed electron-jet to appear only for periods of a fraction of a millisecond at any selected point in the cycle of recurrence, in certain measurements on the ionosphere. The method of operation is here demonstrated on a locally generated screen image.

2. The method of echo-sounding of the ionosphere is illustrated by an acoustic analogy in which ionospheric heights of a hundred kilometres or more are represented by heights under one metre.

15. *The Research Institute of the Cancer Hospital (Free).*

Recent developments in the Production of Cancer by pure compounds of known chemical constitution.

A certain fluorescence spectrum was found to be common to cancer-producing tars and oils, and to another carcinogenic material (obtained by the action of aluminium chloride upon tetralin) of quite different origin. This suggested that the same substance was responsible for the fluorescence spectrum and the cancer-producing power, and this spectrum was used as a guide in the isolation of a compound from two tons of pitch. Examination of this substance suggested 1 : 2–benzpyrene, which was at that time unknown. This compound was synthesised, and was found to be identical in chemical and physical properties with the compound obtained from pitch, and to be carcinogenic. This work is illustrated by specimens of compounds, tumours, spectra, and microscopic sections.

16. *Ilford, Ltd.*

Recent Developments in Infra-red Photography.

The discovery of a new sensitising dye has made it possible to prepare an emulsion of considerably higher speed to infra-red radiation than existed previously. This has led to the widespread application of the process of infra-red photography.

Examples are shown of its use in astronomy, long-distance photography, aerial photography, medical work, photomicrography, investigation of dyestuffs, etc. Its utility in many cases depends upon the fact that infra-red light is less scattered than visible light when penetrating a medium.

With respect to water vapour, the absorption curve to infra-red light is very steep, rising very rapidly in the neighbourhood of 9,000 Å., and it is therefore desirable that the photographic material employed should possess its maximum sensitivity in the extreme visible and the commencement of the invisible infra-red region, by preference in the neighbourhood of 7,400 Å. to 8,500 Å. Curves illustrating this are shown.

17. *Dr. N. U. Meldrum and Dr. F. J. W. Roughton.*

Some properties of Carbonic Anhydrase.

Carbonic anhydrase is the name given to an enzyme which the authors have recently isolated from blood. It catalyses both phases of the reversible reaction $CO_2 + H_2O \rightleftharpoons H_2CO_3$, and hence accelerates not only the evolution of CO_2 from bicarbonates by weak acids (the main chemical mechanism by which CO_2 is eliminated in the lungs), but also the uptake of CO_2 by alkaline solutions or by buffer solutions on the alkaline side of neutrality. These properties will be demonstrated by simple experiments, in which CO_2 output or uptake is followed by pressure gauges or by indicators. The use of the enzyme in volumetric titrations will also be shown.

ROOM 4.

(PRINCIPAL LIBRARY.)

18. *Dr. H. S. Hele-Shaw, F.R.S., and Mr. T. E. Beacham.*

A new Distant Control and Indicating Mechanism for Transmitting Exact Motion to a Distance.

The apparatus, which is a hydraulic telecontrol, consists of two elements, one element (A) operated by a lever, while the other element (B) gives the movement required. The two ends are coupled together by a pipe of small diameter, which can be conveniently carried round any intervening obstacle or round any corners to a required distance.

There is no back-lash, and the movement of the (B) lever faithfully follows that of the (A) lever at any distance, with no appreciable frictional resistance in the pipe.

This control, which is self-locking, has certain advantages over electrical or mechanical systems which have caused it to be applied for operating the throttles on multi-engined aircraft, a special fluid being used so that it can operate effectively in intense cold at great heights.

19. *Mr. J. E. Barnard, F.R.S., and Dr. F. M. Burnet (The National Institute for Medical Research).*

The Virus of Canary Pox.

This virus disease of canaries produces a fatal general infection—the characteristics of the virus suggest that it is closely related to that of fowl pox. Experiments on animals and microscopical observations are closely enough related to suggest that the bodies seen in infected tissues or body fluids are the virus. Stained inclusion bodies and ultra-violet photomicrographs of the virus bodies are demonstrated.

20. *Metropolitan-Vickers Electrical Company.*

Bubbling Valve.

Gas is allowed to bubble through low vapour pressure oil into a vessel connected with an ionisation gauge, which is mounted on an oil condensation pump. The positive ion current, which is roughly proportional to the gas pressure, increases slightly as each bubble forms, showing the diffusion of gas through the oil film. The rapid decay of the large positive ion current produced when the bubble bursts shows the speed of the pump. The residual positive ion current between bubbles is due principally to the evolution of dissolved gas from the oil in the bubbling pot.

21. *The Research Laboratories of the General Electric Company.*

The "Osira" Lamp is a Discharge lamp which runs at ordinary mains voltages, and starts automatically when switched on. It is of very simple construction, consisting of a vacuum-jacketed bulb having two electrodes at opposite ends, and containing a mixture of gases, including mercury vapour. No filament transformer is needed to heat the electrodes, nor is any apparatus needed to start the discharge. The lamp is connected to the A.C. supply mains through a choke; this is necessary to stabilise the discharge.

The efficiency is very high; including the losses in the choke, the initial efficiency of the 420-watt type at present made is 38 lumens per watt, as compared with the 15½ lumens per watt given by a tungsten filament gas-filled lamp of similar wattage.

The actual source of light appears as a narrow luminous cord about 6 inches long and ¼ inch in diameter. The lamp has, so far, been particularly applied to street-lighting.

22. *Messrs. Dewrance and Company.*

Bi-Colour Water Level Indicator.

The Bi-colour water-level indicator is designed to give a clear indication of the water-level in a boiler drum, showing the water space and steam space in contrasting colours. The indicator is in the form of a hollow prism built up with toughened glass plates, protected by sheets of mica from the etching effect of the condensed steam.

Light transmitted through the indicator below the water-level is refracted by the water prism through a small angle, while light transmitted above the water-level emerges parallel to its original direction. Colour screens are provided to distinguish between the two beams.

Two models are shown, one for direct reading, the other for indirect reading by means of two mirrors, also a section of the indicator and illuminator.

23. *Professor A. C. Hardy.*

Continuous Plankton Recorder.

This instrument, when towed like a paravane behind a ship, continually samples the microscopic life in the water traversed. Across the flow of water through the machine, a long banding of fine silk netting winds into a preservative chamber. Geared rollers are worked from the water by a propeller, the adjustable blades of which allow each of a series of numbered divisions on the moving silk to represent a mile or more of sea. The rolls having a 250-mile capacity are easily changed, like Kodak spools, the used ones being kept for examination on a special microscope substage. Thus the varying density and composition of the plankton may be quantitatively studied on an unbroken line of observation across the sea.

24. *Prof. A. C. Hardy and Mr. P. S. Milne.*

Insect Distribution.

Methods similar to those used in Oceanography for sampling the plankton by means of tow-nets, opened and closed at will, are being employed to collect insects at different heights above ground level. The net is carried up closed to the desired height by one or more kites, opened by a chemically-controlled release mechanism, allowed to remain open collecting for a pre-determined period, and then hauled down after being closed by the mechanism. By this means a knowledge of the influence of wind upon the distribution of insects is being obtained. Particular attention is being paid to agricultural pests, and their possible introduction into this country from the Continent at high altitudes. Collections made at different heights are shown.

25. *Mr. George H. Gabb.*

"The Royal Society Thermometer"—The Earliest Standard Thermometer in England.

The thermometric scale known as "The Royal Society Thermometer" was the first attempt to establish a Standard Thermometer in England. Recent research in the archives of the Royal Society has revealed its origin, and that it is only ante-dated by the Florentine scale of the Academia del Cimento.

It is recorded in the Minutes of the Society of October 21st, 1663, a year after its foundation.

"The operator (Richard Shortgrave) produced again the thermometers with spirit of wine, and said they did all agree at the figure 8. It was ordered that one of them should be kept by the Society as a Standard, and all the rest to be adjusted as to agree therewith."

Its only fixed point was apparently based on the temperature of the human body, inaccurately registered at that early period of thermometry at about the equivalent of 88° F., an error due to the large size of the bulbs then in use. The scale was graduated from this point as zero downwards to 90°, "Hard Frost" being indicated at about 85°, the importance of the freezing point of water, as a second fixed point, being unrecognised.

John Patrick, "the Torricellian Operator of the Old Baily," tells us that he graduates "all his thermometers by those standards."

George Martine, F.R.S., in his "Essay towards comparing different Thermometers" (London, 1740), states: "The most common Thermometers in England are those made after the Standard one kept in the Royal Society, and many fashioned on this plan have been sent into foreign parts to establish a correspondence of observations concerning the weather in different countries, so as to enable us to compare it with other Thermometers."

Five original examples of "Royal Society Thermometer" scales (*c.* 1690–1740) from the Gabb Collection are exhibited, the work of John Patrick, of Old Baily, Patrick Sullivan of "Temple Barr," etc., including "A General Thermometer," *c.* 1735. This consists of a circular silver plate, $4\frac{5}{8}$-inch diameter, on which are engraved in concentric circles the scales of 16 different experimental Thermometers of that period, having a movable index, by which the equivalent temperature of any scale is indicated.

26. *Mr. J. D. Brunton, Professor B. P. Haigh and Mr. T. S. Robertson.*

Fatigue Testing Machine (for wire) in operation.

In testing wire, difficulty has been experienced in obtaining fatigue fractures elsewhere than at the grips, where stresses are indeterminate. In the machine exhibited, this difficulty is overcome, fracture being obtained in the middle of a long piece that is flexed as a strut and caused to rotate at a high speed (up to 150 million per week).

The curvature of the wire is measured by the angle of flexure, or alternatively by the deflection, and the range of stress is deduced. The endurance is measured by a counter. Special bearings are employed to transmit the thrust along a definite line of action.

27. *Dr. L. Simons and Mr. E. H. Smart.*

A Model to illustrate the Classical Motion of a Diatomic Rotator with Two Degrees of Freedom.

Two atoms (in the model two coloured lamps) rotate so that while they move at the opposite ends of a diameter round a circle with a uniform angular velocity $\dot{\theta}$, the plane of this circle moves simultaneously and independently with a uniform angular velocity $\dot{\phi}$ round a fixed control axis. The paths of the atoms intertwine on the surface of a fixed sphere. The projections of the paths on the equatorial plane are $r_1 = a \sin \frac{p}{q}\phi$, $r_2 = a \sin\left(\frac{p}{q}\phi + \pi\right)$, if $\dot{\theta} = \frac{p}{q}\dot{\phi}$. If p and q have low integral values, the paths are fixed in space and can be followed by eye. If $\frac{p}{q}$ is incommensurable they precess in azimuth ϕ. If p and q are odd, the paths split in azimuth.

28. *The National Institute for Medical Research, Hampstead.*

Apparatus for the Rapid Study of Ultra-violet Absorption Spectra. (*Mr. J. St. L. Philpot and Dr. E. H. J. Schuster, and Mr. F. A. Askew.*)

The apparatus shown includes a photo-electric densitometer for measuring the distance apart of points of equal density on the spectrogram of the substance under examination, and on a comparison spectrogram.

An apparatus is also shown for converting the distance readings thus obtained to extinction coefficients, and plotting these against wavelength.

29. *Professor W. A. Bone, F.R.S.*

(*a*) Photographs showing Influences of Strong Electrical and Magnetic Fields upon the Phenomenon of "Spin" in Gaseous Detonations (*Professor W. A. Bone, F.R.S., and Messrs. R. P. Fraser and W. H. Wheeler*).

The photographs, taken by the new Fraser high speed mirror camera, show the passage of 2 CO + O_2 detonation flames through strong electric and magnetic fields.

(*b*) Explosions of $C_2H_2 + O_2 + 2\ H_2$ Media in Glass Bulbs (*Prof. W. A. Bone, F.R.S., Dr. D. T. A. Townend, and Mr. L. E. Outridge*).

These explosions (six of which will be made at convenient intervals during the evening) demonstrate the striking fact that neither carbon is deposited nor steam formed when the medium is inflamed, the reaction proceeding according to the equation

$$C_2H_2 + O_2 + 2\ H_2 = 2\ CO + 3\ H_2,$$

or, in other words, the acetylene is burnt preferentially to 2 CO + H_2, leaving the original hydrogen intact.

30. *Sir Robert Hadfield, Bt., F.R.S.*

Specimens of Metallurgical Interest, mainly Ferrous, including a large series of tensile and other tests at the Temperature of Liquid Hydrogen (—252·8° C.)

1. Tested specimens, 82 in number, showing the Effect of the Temperature of Liquid Hydrogen (—252·8° C.) on the Tensile Properties of Iron and Ferrous Alloys, also Copper, Nickel and 4 Non-ferrous Alloys.

2. Chart showing the position of Liquid Hydrogen in the temperature scale, in relation to other points of reference.

3. Demonstration of the varying Effect of Low Temperatures on the Mechanical Properties of Metals and Alloys, by actual shock tests carried out with specimens cooled in Liquid Air (—182° C.).

4. Tensile Tests in the Tensometer apparatus demonstrating the Mechanical Properties of typical Alloy Steels.

5. Chart illustrating the great range of industrial temperatures in which Ferrous Alloys are now successfully employed.

6. Tubes of " Era H.R.3 " Heat Resisting Steel produced by Extrusion.

7. Specimens of the original Basic Steel made by the Thomas Gilchrist Process, with the results of the analytical and other examination of them by the exhibitor.

8. Specimens of Ancient Indian Iron and Steel,

(*a*) From Kotas in the Nilgiris.
(*b*) From the Museum at Taxila, Punjab.

Some of these, for example, No. 4 on the photograph accompanying the exhibits, are stated on the authority of Sir John Marshall, C.I.E., Director General of Archæology in India, to date back to the seventh century B.C., that is, about 2,600 years ago.

9. Diagram showing the Annual World Production of Iron and Steel from the year 1800 to the present time.

31. *The Western Electric Company.*

Western Electric 2–A Artificial Larynx.

This Artificial Larynx is designed to restore the power of speech to those who suffer from vocal paralysis or those who have undergone surgical removal of the natural larynx.

The instrument consists of a sound box which contains a delicate metal reed. One end is connected to the trachea opening by rubber tubing and from the other end another piece of rubber tubing projects into the mouth. A breathing hole in the side of the sound box enables the user to inhale and exhale freely. When the user desires to speak the thumb or finger is placed over this opening, thus forcing the air, when exhaled, to strike the reed, causing it to vibrate. The sound thus generated enters the mouth through the rubber mouthpiece, and is modulated into articulate speech by the action of the mouth, throat and nasal cavities, as in ordinary speaking.

For vocal paralysis, bellows are used.

32. *Department of Mineralogy, British Museum (Natural History).*

Single Crystal of Meteoric Iron (*Dr. L. J. Spencer, F.R.S.*).

In order to determine the crystallographic orientation of the rough mass from the meteorite craters in Central Australia, a sphere was cut and polished and then etched. Plane surfaces were then cut parallel to the faces of the octahedron, cube, and rhombic-dodecahedron, on each of which is shown a different pattern of the lamellar octahedral structure. (The work was done in the metal workshop of the Science Museum, by kind permission of the Director.)

33. *Mr. R. C. French.*

Series of Diffraction Patterns to show the decrease produced by polishing in the size of the Crystals in a Metal Surface.

Under suitable conditions, the width of the rings in an electron diffraction pattern is a measure of the size of the crystals causing them, the smaller the crystals the broader the rings. The series shows the gradual breakdown of the crystals of the surface of the metal into smaller and smaller aggregates, until it is almost amorphous. This is in accordance with the theory of the late Sir George Beilby.

34. *The Science Museum.*

Sir Richard Threlfall's Automatic Microtome.

Sir Richard Threlfall designed the first automatic microtome for cutting series of sections; it was completed in 1883. The machine shown is an exact duplicate of the one made for Threlfall.

The knife is kept fixed, and the object moved across it. A driving wheel is arranged to impart a horizontal reciprocating motion to a slider which carries a micrometer screw, at the top of which is mounted the object-carrier. At every complete turn of the driving wheel the object is raised by means of a pawl and ratchet actuating the micrometer screw. The thinnest section which can be cut is 0·005 mm. A ribbon is arranged for receiving the series of sections.

35. *Dr. R. T. Gunther.*

The Measuring Instruments used by English Astronomers of the Fourteenth Century.

13½-inch Astrolabe associated with Simon Bredon, *c.* 1340.

14¼-inch Astrolabe made for "Lat. 52° 6″ Oxonia," with planetary circles on the back, *c.* 1350.

New Quadrant of Profacius, *c.* 1301–50. 1-foot radius.

Navicula or Ship Dial, *c.* 1400.

Cylindrus. A MS. figure of 1350.

Semissis. (Model.)

Rectangulus of Richard of Wallingford, 1326. (Model.)

Turketus, *c.* 1350. (Model.)

A water-colour sketch of the entrance to the Old Ashmolean Museum, Oxford, opened on May 21, 1683. By Bernard Gotch, 1932.

36. *The Gas Light and Coke Company.*

The Crystallisation of Ammonium Sulphate, and the effect of certain added impurities on its habit.

The photomicrographs and specimens illustrate the change in habit of ammonium sulphate crystals obtained from a solution containing very small amounts of certain impurities; for example, a solution containing 0·003 per cent. iron will yield crystals of long pointed hexagonal habit. A pure solution yields, under exactly similar conditions, compact rhombic crystals. Similar

habit variation is produced by other impurities in the solution, notably aluminium, chromium and beryllium.

The importance of this in the production of ammonium sulphate as a fertiliser is that the long pointed crystals do not cake into hard lumps on storage or during transit, whereas the usual type of crystal tends to cake badly. This difference is closely connected with the smaller area of contact of the former in bulk.

37. *Department of Zoology, British Museum (Natural History).*

A Dodecapodous Pycnogonid. (*Dr. W. T. Calman, F.R.S.*)

The Pycnogonida are a group of marine Arthropoda having, typically, four pairs of legs. Besides some 400 species of this normal type, there are now known five species (all, except one, from Antarctic seas) with five pairs of legs. Sir Douglas Mawson, on his recent Antarctic voyage, obtained the new form exhibited, which has six pairs of legs. Together with it are exhibited the closely allied *Decolopoda* (five pairs) and *Colossendeis* (four pairs). The view is taken that the eight-legged type represents the primitive and relatively stable condition. Once this standard is departed from, however, the difference between ten and twelve legs is of minor importance.

38. *Mr. S. Maulik.*

1. Structure of Hispine Larvæ and their spiracular devices.

These larvæ are either leaf miners or live between leaves of unopened buds. Respiration therefore is a problem with them; consequently they show various modifications of the spiracles. Other parts of the body are also accordingly modified. These larvæ are all new to science.

2. A Tubular Structure in a modified antennal segment of the males of some Chrysomelid beetles.

One of the antennal segments of males of *Agetocera* (Chrysomelidæ) is much enlarged and modified. In this peculiar segment there is a tube leading to an orifice on the surface. There are numerous tubules ramifying from the tube in all directions. Such an internal structure in insect antenna has not been found before.

39. *Dr. L. S. B. Leakey.*

Early Prehistoric Man in East Africa. (The Kanam Mandible and Kanjera Skulls.)

During the first half of 1932 fossil remains of man were discovered at Kanam and Kanjera. The Kanam mandible was found in Lower Pleistocene deposits and was associated with a very primitive type of stone tool. The Kanjera skulls are rather later in date and were found with tools of the Chellean culture stage, which occurs over most of S.W. Europe. These remains represent the earliest known men from Africa, and the Kanam mandible was about the same age as the Piltdown skull.

40. *Mr. D. G. MacInnes.*

Fragments of Fossil Anthropoids from the Miocene Deposits of the Victoria Nyanza Basin.

Fragments of some Fossil Anthropoid Apes, obtained by the East African Archæological Expedition under the leadership of Dr. L. S. B. Leakey. These remains were found in deposits of Miocene age on Rusinga Island, near the eastern shore of Lake Victoria. Associated with the Anthropoid material was a fairly extensive fauna, the detailed study of which has not yet been completed.

41. *Mr. D. G. MacInnes.*

Birds' Eggs from the Victoria Nyanza Area of Kenya Colony.

Variations in the colour of the eggs of a single species is a well-known phenomenon, but it is seldom carried to the extremes found amongst certain species of the Weaver birds in Africa. During 1932 considerable numbers of the eggs of some of these species were examined, particularly of the genus *Hyphantornis*, and these exhibited series show some of the extreme colour variations, and also some of the intermediate forms which may be obtained within a single species.

42. *Mr. R. S. Whipple.*

1. Ben Jonson's copy of William Gilbert's "De Magnete."

The first edition of this famous book was published in 1600, the second and third editions in 1628 and 1633. Three different issues are known of the second edition, of which Ben Jonson's copy, having the engraved title showing the compass trailing after the ship, is the rarest.

Ben Jonson's comedy "The Magnetic Lady," was first brought out in October, 1632. The chief characters in the play are evidently connected with magnetism, although there are not many references to the subject in the play. On page 16 the priest of the parish addresses Lady Loadstone as follows :—

> " Pursue your project real, Master Compass
> Advised you to : he is the first instrument
> Your Ladyship should sail by."

Again on page 18 Lady Loadstone's friend Polish addresses her :—

> " Your ladyship is still the lady Loadstone,
> That draws, and draws unto you, guests of all sorts ;
> The courtiers, and the soldiers, and the scholars,
> The travellers, physicians, and divines,
> As doctor Ridley wrote, and doctor Barlow :
> They both have writ of you and master Compass."

2. John Flamsteed's copy of Vincent Wing's "Astronomia Britannica."

Published 1669. Contains his autograph and is dated 1670, six years before his appointment as the First Astronomer Royal. A note (1710) authorising the payment of a labourer for work done in the Observatory is included.

3. Architect's scales to facilitate the drawing of the various orders of columns, Tuscan, Doric, Ionic, etc.

With the instructions for use by Nicholas Goldmann, 1662.

43. *Professor E. W. MacBride, F.R.S., and Mr. J. M. Watson.*

The Ear Bones of the Goldfish.

In a group of fresh-water fish, the Ostariophysi, the air-bladder is connected with the internal ear by a chain of small bones, the Weberian Ossicles, connected with each other by ligaments. This chain is kept in a state of tension by the action of certain muscles, and is capable of transmitting to the ear vibrations, not necessarily those of sound, received by the air bladder. The exhibit shows the Weberian Ossicles and the vertebræ with which they articulate in a dissection of a fish (*Carassius auratus*) prepared by the alizarin transparency method, and also microscopic preparations of the chain and of the individual ossicles.

44. *Professor E. W. MacBride, F.R.S.*

The Effects of Disuse as illustrated by a stuffed specimen and a skeleton of the "Flightless Cormorant" which inhabits the Galapagos Islands.

The skeleton shows quite clearly the entire absence of a keel on the sternum and the very much shortened bones of the manus which are correlated with the reduced wing.

The stuffed specimen shows in an extended position the feeble wing with the short primary feathers, which are quite useless for the purposes of flight.

45. *Dr. C. Russell Amies, the Lister Institute, London.*

New Studies on Varicella. Demonstration of the elementary bodies in varicella and their agglutination in pure suspension by the serum of chickenpox patients.

That elementary bodies, probably somewhat smaller in the stained condition than those of vaccinia (0·2 μ) occur in enormous numbers in the fluid of early chicken-pox vesicles was reported many years ago by Aragao and Paschen. In default of susceptible animals for direct transmission experiments, evidence in support of the etiological importance of these bodies has been sought by Dr. Amies on serological lines, following those of Ledingham (1931) in the case of the Paschen Bodies of vaccinia. The exhibit includes (1) microscopic preparations of the elementary bodies in varicella (2) pure suspensions of the same, and (3) preparations showing the clumping of the bodies in the presence of serum from chicken-pox patients and convalescents.

ROOM 5.

46. *Dr. J. Chadwick, F.R.S., and Dr. C. E. Wynn-Williams.*

Production and Detection of Neutrons.

The neutrons are produced by the bombardment of a beryllium plate by the α particles from a strong polonium source. The neutrons pass into an ionisation chamber coupled to an amplifier. A nitrogen atom struck by a neutron may acquire sufficient energy to give rise to a small ionisation current which, after amplification, is detected by means of a simple thyratron circuit. The ejection of fast protons is shown by the increase in the number of thyratron flashes when a sheet of paraffin wax is placed in front of the chamber. The great penetrating power of the neutrons can also be demonstrated by passing them through a block of lead.

GROUND FLOOR.

ROOM 6.

(END OF CORRIDOR.)

47 *The National Physical Laboratory.*

Automatic Measurement and Counting of Time Intervals (*Mr. A. Felton*).

The measurement of quantities such as speed of rotation, or of recurring events, is carried out automatically. The equipment shown can be set to record the total time for any number of events from 1 to 100. The apparatus is started by closing a switch, after which, the first time the " event " occurs, a chronograph is set in motion. After the pre-selected number of events have taken place, the chronograph is automatically stopped.

The apparatus shown is operated from a photo-electric cell, illuminated periodically by light reflected from a small mirror on the spindle of an integrating electricity meter. The time for any number of revolutions up to 100 can thus be recorded automatically.

48. *The Cambridge Instrument Company.*

Mallock Equation Solving Machine.

An electric calculating machine, invented by R. M. Mallock, M.A., which will solve up to ten linear simultaneous equations between ten unknowns. Each of the 110 possible coefficients can be set on a three-figure dial by means of three push switches. The values of the unknowns appear as the resultant fluxes in a number of transformers, and are read off directly on a five-figure dial operated in a null reading potentiometric balancing method. The instrument—which has been designed and made by the Cambridge Instrument Co., Ltd.—has been made possible by the use of mumetal in the transformers, together with automatic compensating circuits with valve amplification.

49. *The National Physical Laboratory.*

Use of Cathode-ray Oscillograph for obtaining frequency response curves of electrical loudspeakers, etc. (*Dr. A. H. Davis and Mr. N. Fleming*).

Oscillographs are normally used for recording the variation, as time changes, of the response of the system under observation.

The demonstration shows how a frequency scale can be attained on a cathode ray oscillograph, instead of a time scale, and applies the arrangement in conjunction with a microphone to obtaining curves showing the relation between the response of a loudspeaker and the frequency of the exciting current. The frequency scale is approximately logarithmic.

The loudspeaker-microphone system can be replaced by any system (electrical filters, etc.) in which an electrical output results from an electrical input.

IN THE HALL

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50. *Department of Geology, British Museum (Natural History).*

The Liassic Shark, *Hydobus lauffianus* Fraas.

Well-preserved examples of *Hybodus*, of which the nearest living allies are the Port Jackson Sharks—*Heterodontus*—are occasionally found in the bituminous shales of the Upper Lias (Lias *E*) of central Württemberg. The exhibited specimen, which is seven feet in length, shows especially well the form of the body and the paired fins with their supports. The head region is seen from below, but the rest of the fish is in side view.

MEETING ROOM.

At 9.15 and 10.15 o'clock.

By *Mr. Olaf Bloch*—

A Lecture, illustrated with Lantern Slides—

on Recent Developments in Infra-red Photography.

At 9.45 and 10.45 o'clock.

By *Lieut.-Col. L. V. S. Blacker*—

A Lecture, illustrated with Lantern Slides—

on The Houston Mount Everest Expedition.

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